Al Khawarizmi
Journal of Mathematics Education and Learning

journal homepage: https://jurnal.ar-raniry.ac.id/index.php/alkhwarizmi

STUDENTS' DIFFICULTY WITH *NEWMAN'S ANALYSIS* IN SOLVING HOTS TYPE QUESTIONS

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Info article

History articles:
Received 23 Desember 2023
Received in revised form 5 June 2024
Accepted 06 June 2024
Available online 11 July 2024

Keywords:
Fractions, HOTS Problems, Newman

Abstract

Abstract this study aims to determine the type of student error in solving Higher Order Thinking Skills (HOTS) type questions. using Newman analysis with indicators of Reading, Comprehension, Transformation, Process Skill, Encoding. This research uses a qualitative approach with a descriptive type of research. The subjects in the study amounted to 17 grade V students of SDN Mantingan 2. Data collection using test techniques using fractional material HOTS test questions conducted 2 times which were then analyzed using Newman Theory error analysis. The results of research from 17 grade V students of SDN Mantingan 2 showed that there were student errors in Reading of 17.6%; Comprehension by 18.6%; Transformation by 20.5%; Process Skill by 45%; Encoding by 57.8%. In this study, it was concluded that students' errors in doing problems on the comprehension and reading indicators were the cause of students doing wrong even though most of the biggest mistakes were in the encoding indicators.

INTRODUCTION

The 2013 curriculum requires students to involve their analytical and reasoning skills to solve problems in their daily lives. This is in accordance with students' ability to think *Higher Order Thinking Skills* (HOTS) which includes the ability to understand and grasp the problems to be faced creatively, logically, critically, reflectively and metacognitively (Rohmatillah & Sutarni, 2023; Tanujaya et al., 2020). HOTS thinking is required to understand facts, principles, concepts and stages of problem solving or resolution procedures (Alfarisa et al., 2022; Azid et al., 2022). This statement means that in thinking HOTS students must be able to master complex problems in order to find solutions to solve problems .

Implementation of the 2013 Curriculum in Elementary Schools requires the creation of learning that is in line with current developments. Apart from that, the 2013 Curriculum emphasizes *scientific applications* such as: observing, asking, trying, processing, presenting, concluding and creating (Usmaedi, 2017). HOTS is basically good for developing students' thinking abilities, however, efforts still need to be made to evaluate the implementation of HOTS (Musa & Samsudin, 2021). Orientation in the world of education today is not just about transferring knowledge by teachers to students, but more than that, namely preparing students to be able to face an increasingly modern and advanced era. In practice, HOTS is needed by students to face real life problems , namely is detailed, unstructured, complex, new, complicated, and requires thinking skills that are not limited to applying the knowledge learned (Azid et al., 2022; Moyo et al., 2022). To be able to think at a higher level, the 2013 Curriculum began to develop HOTS type questions (Gradini, 2022; Nurlaily et al., 2021; Tanujaya et al., 2020).

HOTS type questions are questions that contain descriptions of everyday problems to train students in logical, critical, reflective, creative and metacognitive thinking. Apart from that, HOTS questions require a reasoning process, so that students are expected to be able to improve their high-level thinking abilities. HOTS questions also hone thinking skills at the level of analyzing, evaluating and creating. According to Thomas and Thorne, (Febryana et al., 2023) HOTS is a thinking skill that does not just memorize facts or just understand concepts, but students also have to understand, analyze, manipulate, categorize and create something creative.

This activity can be useful to make it easier for students to complete HOTS type questions. HOTS type questions require high-level thinking skills, which means students are required to analyze, so that they are in accordance with the elements of solving story problems that require problem solving, analysis in the use of rules used in solving them. (Wati & Sary, 2019). It can be seen that students' thinking processes can be identified through solving story problems. To solve story problems well, students must learn to analyze and use appropriate evidence for consideration in solving problems. If they don't have good HOTS, students will have difficulty working on story questions. (Suci et al., 2023; Suryanti & Istiqomah, 2020).

Based on the results of observations at SDN Mantingan, there are many class V students who experience difficulties in learning Mathematics, namely the Fraction material section, students find it difficult when working on fraction calculation operations, both multiplication, division, addition and subtraction, especially HOTS type fraction material questions which require the ability to think at a high level, students are not yet accustomed to solving and solve problems with a high level of thinking, therefore they experience difficulties. In mathematics there are various sets of numbers such as real, complex, rational numbers, and many others. The set of rational numbers is considered difficult for students, especially in the set of fractional numbers, on average students make mistakes in solving questions on this material. The difficulty in completing operations to calculate fractional numbers is also proven in research that has been carried out regarding operations to calculate fractional numbers that have been given to 65 students in class V of Pengawu State Elementary School, it can be concluded that there are still many students who have difficulty

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understanding Fractions and are still weak in Fractions. (Wati & Sary, 2019). This article uses Newman's analysis system called *Newman Error Analysis (NEA)* because *NEA* has a close relationship with story problems which require the concentration of reading, understanding, and changing story problems into mathematical form before being solved (Febryana et al., 2023). Therefore, there is a need for further research regarding the aspects that make it difficult for students to work on HOTS type questions using *NEA. By applying the NEA indicator, the researcher intends to show that students' mistakes in doing mathematics problems are not only in the final calculation.* The NEA indicators used in this research consist of 5 indicators as in table 1 .

Table 1
***Newman Error Analysis* Indicator**

No.	Indicator	Explanation
1.	Reading	Errors in reading words, terms and mathematical symbolization presented in the problem
2.	Understanding (*Comprehension*)	Errors in capturing and understanding the meaning of the question
3.	Changing shape (*Transformation*)	Errors in changing story problems into mathematical models and calculation operations
4.	Process *Skills*	Errors in the steps or processes in solving the problem
5.	Writing the Final Answer (*Encoding*)	Error in writing down the solution results

RESEARCH METHODS

Types of research

The research method used is a qualitative approach, research using qualitative research is research with a method based on philosophy in the form of *postpositivism* (Slater, 2017), for researchers this philosophy is used in natural object situations, namely the researcher becomes the key instrument, here the data source is carried out snowballing and *purposively* in sampling, while for data collection using triangulation (combined) techniques, data analysis is quantitative or inductive and the results obtained from qualitative research are often emphasized on generalization.

Time and Place of Research

The research was carried out in September 2023 at SD Negeri 2 Mantingan which still uses the 2013 Curriculum.

Research Subjects / Population and Sample

The research subjects were 17 class V students who were categorized as students with high, medium and low learning outcomes.

Procedure

The research procedure was carried out by collecting data first, carried out directly, namely giving HOTS test questions 2 times with a gap of 2 weeks. Then after the researcher obtained the data, the data was reduced using *NEA* . The results of analysis with *NEA* are presented in the form of tables, graphs and descriptions to make it easier to understand the analysis results. Based on the results of this analysis, the researcher drew conclusions from the five *NEA indicators* that needed to be provided with solutions to solve the problem.

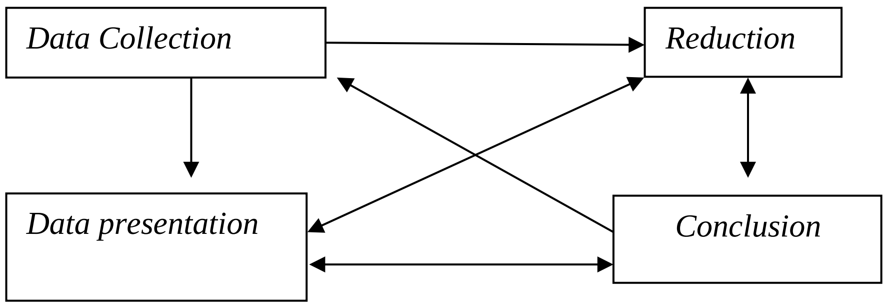


Figure 1. Research procedures(Sugiyono, 2018)

Data Sources , Instruments , and Data Collection Techniques

The data source for this research was class V, a total of 17 students who were asked to complete HOTS type fraction questions twice. The instrument of this research is HOTS type story questions with cognitive level C4-C6 adapting the basic competency of fraction material in class V. The data collection technique was carried out by giving test questions with different descriptions 2 times with a gap of 2 weeks.

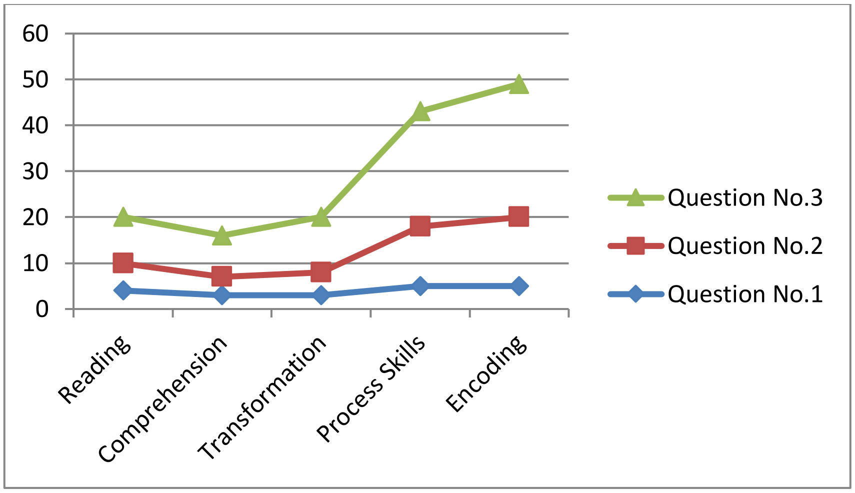
Data analysis technique

The data analysis technique uses *Newman Error Analysis (NEA)* , which is an analysis method used to find the location of errors in solving story problems. There are five indicators for finding the location of the error. The five indicators are: reading , comprehension , transformation , process skills *and* encoding *according* to the NEA indicators outlined in table *1 .*

RESEARCH RESULTS AND DISCUSSION

Research result

The research was conducted on 17 fifth grade students using HOTS type story questions on fraction material twice with different questions. Below is presented data regarding answer errors made by students.



Graph 2 . Observation Results of Errors in Working on the First Question

Researchers have carried out an analysis of students' test results based on the types of errors according to Newman's Theory. Information has been obtained that in the results of the first test answers, the most errors made by students were number 3, then number 2 and the least errors were number 1.

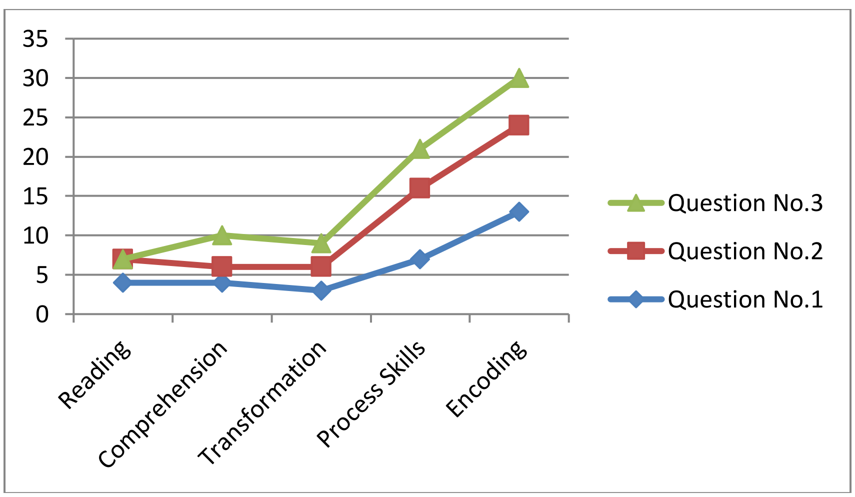


Figure 3. Observation results of errors in working on the second question

The results of the second test scores, the researchers have carried out an analysis according to Newman's theory of error analysis, obtained the data above. Information was obtained that in this second test, students made the most mistakes on number 1, then 2 and 3 . In accordance with the data above, the researcher described the scores of each student in the first test and second test to make it clearer. The results of the answers from 17 subjects had been corrected and assessed by the researcher. To make it easier to read the results of the research, the researcher summarized the results of the errors in the second test carried out by each student into one table of the total number of student errors according to the types of errors made. The following are the results of the total number that has been grouped by researchers:

Table 2
First Test Student Error Data

Question No	**Error Type**				
	Reading	***Compreh ension***	***Transfor mation***	***Process Skills***	***Encoding***
1.	3	2	2	5	5
2.	3	2	3	7	10
3.	5	5	7	13	14
Amount	11	9	12	25	29
Percentage	21.5 %	17.6 %	23.5 %	49 %	56.8 %

Based on table 2, it is known that from the results of the answers to the first 3 test questions there were 56.8% errors in *encoding* or writing the final results and 49% *process skill errors occurred* .

Table 3
Second Test Student Error Data

Question No	**Error Type**				
	Reading	***Compre hension***	***Transfor mation***	***Process Skills***	***Encoding***
1	4	4	3	7	13
2	3	2	3	9	11
3	0	4	3	5	6
Amount	7	10	9	21	30
Percentage	13.7 %	19.6 %	17.6 %	41.1 %	58 %

Table 3 is data on the results of test 1 which consists of 3 HOTS questions. Based on table 3, it is known that of the 3 questions there were 58% errors in *encoding* or writing the final results.

Answer errors made by students when solving HOTS type questions with Fraction Material based on the *Newman Analysis Error (NEA) procedure* are discussed based on the highest percentage.

1) *Encoding* Indicator Student Errors

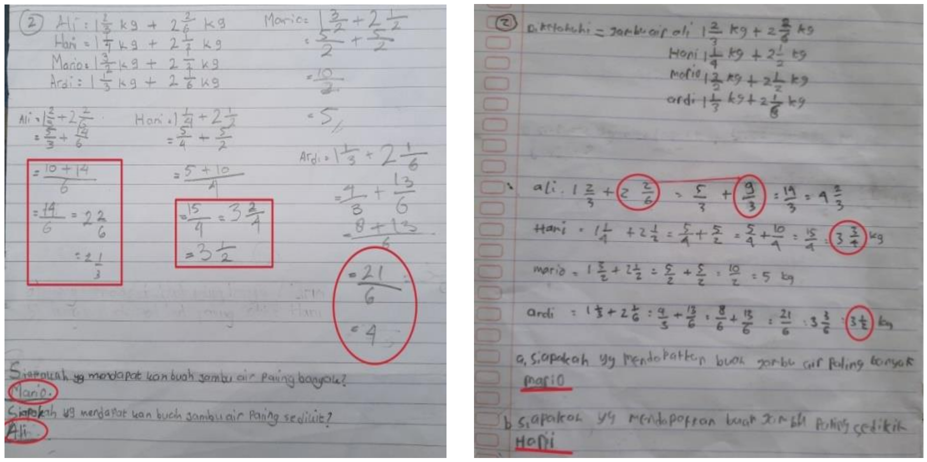


Figure 4. Answer Sheet Showing *Encoding Errors*

Figure 4 is the result of the test answer data which has been analyzed, some information was obtained on question number 2, the first answer sheet revealed an error in *encoding* , where the student was wrong in calculating the total of Ali, Hani and Ardi guava fruit, namely at the end of the calculation, it can be seen in the picture, due to lack of accuracy in counting, students should have counted Ali guava fruit $\frac{10+14}{6} = \frac{24}{6} = 4$, counted Hani guava fruit $\frac{15}{4} = 3\ \frac{3}{4}$ but due to lack of accuracy in counting they answered $\frac{15}{4} = 3\ \frac{2}{4}$, counted Ardi guava fruit $\frac{21}{6} = 4$ which made students answer incorrectly that the one who got the least fruit is Hani. On the second answer sheet , an *encoding* error was obtained , it can be seen in the picture that the students did not understand that $3\ \frac{3}{4}$ with $3\ \frac{1}{3}$ is less than $3\ \frac{1}{3}$, so the students were wrong in the final answer which should be less than the number of Ardi fruit, namely $3\ \frac{1}{3}$ kg, not Hani $3\ \frac{3}{4}$ kg.

2) Student Errors *Process Skill Indicators*

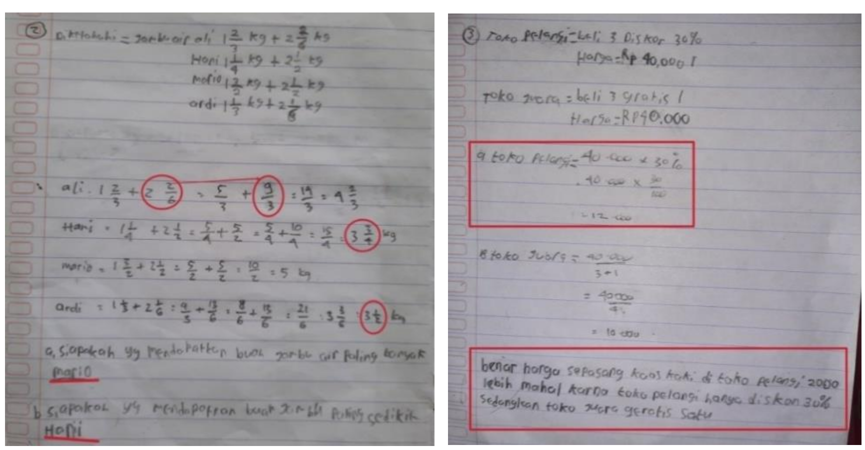


Figure 5. Answer Sheet Showing *Process Skill Errors*

Figure 5 is the result of analysis of the test answers that have been carried out. Some information was obtained that on the first answer sheet the students made mistakes in *Process Skills* and *Encoding* . Process skill errors are caused by students changing the form of mixed fractions into improper fractions incorrectly. It can be seen in the picture of calculating the number of Ali fruits, when students change the mixed fraction 2, $\frac{2}{6}$they change it into an ordinary fraction $\frac{9}{3}$, which is wrong. The correct result is the denominator (6) multiplied by 2 plus the numerator (2), the result is $\frac{14}{6}$. Then on the second answer sheet the students made a mistake by thinking that the calculated result was the price of socks, which was actually the total discount obtained. The students should have calculated further, namely reducing the total price with the discount price obtained: 40,000 – 12,000 = 28,000 then divide it by 3 socks, $\frac{28.000}{3}$= 9,333. So the price of socks at Toko Pelangi is Rp. 9,333.

3) *Reading* Indicator Student Errors

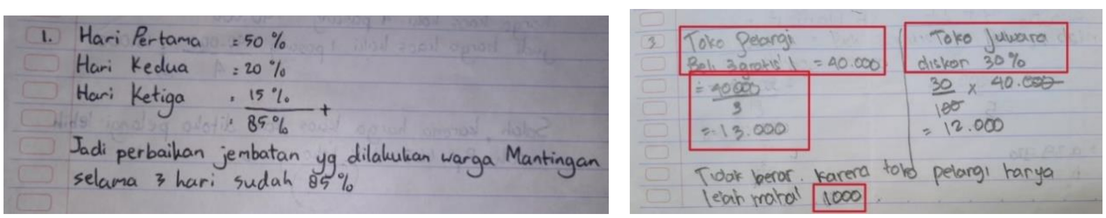


Figure 6. Answer Sheet Showing *Reading Errors*

Figure 6 is the result of analysis of the test answers that have been carried out. Some information was obtained that in question number 1, students made *reading errors* , where students were not careful in reading the question, students did not read that the instructions in the question ordered the answer to be expressed in ordinary fractions, here the students express and calculate the answer in the form of a percentage. 85% should be made into a fraction, that is, $\frac{85}{100}$or it can be simplified again to $\frac{17}{20}$.

4) *Transformation* Indicator Student Errors

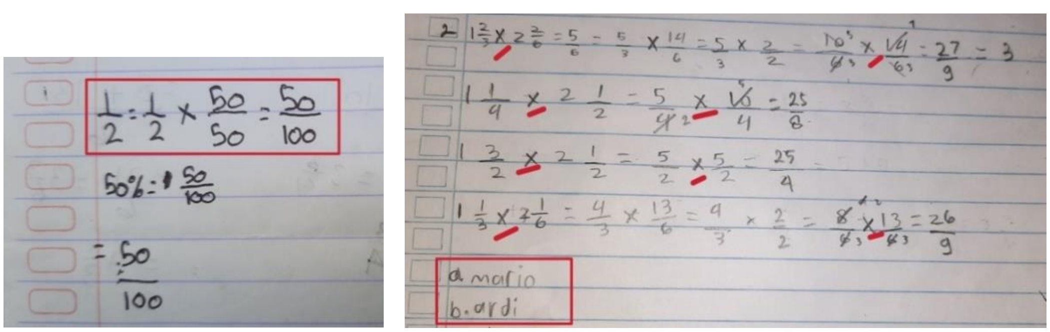


Figure 7. Answer Sheet Showing *Transformation Errors*

Figure 7 shows the results of data analysis of test answers that have been carried out, information is obtained that in question number 1, students made four errors, namely errors in *Comprehension*, *Transformation*, *Process Skill*, and *Encoding*. Mistakes in understanding the question, students do not understand what is meant by the question and cannot grasp the information contained in the question. Errors in transforming questions, students cannot change word problems into mathematical formula form, students should change the percentage form into fraction form first.

Improvement on day 1 = $\frac{1}{2}$part

Improvement on day 2 = 20% = $\frac{20}{100}$= $\frac{2}{10}$=$\frac{1}{5}$

Improvement on day 3 = 15 % = $\frac{15}{100}$. Apart from that, students are wrong in their process skills, namely they are wrong in carrying out calculations, which should be calculated as follows: $\frac{1}{2}$+ $\frac{1}{5}$+ $\frac{15}{100}$= $\frac{50\ +\ 20\ \ +15}{100}$= $\frac{85}{100}$= $\frac{17}{20}$part.

5) *Comprehension* Indicator Student Errors

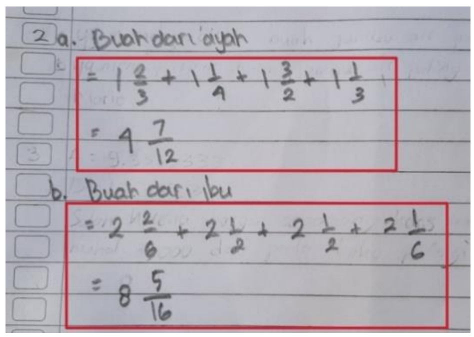


Figure 8. Answer Sheet Showing *Comprehension Errors*

Figure 8 is the result of analysis of test answers that have been carried out. Some information was found that in question number 2, students made five mistakes, namely *Reading* , *Comprehension* , *Transformation* , *Process Skill* , and *Encoding* . Students made mistakes in reading the questions and understanding the questions, students did not read the symbols and terms in the questions correctly and did not understand the meaning of what was asked in the questions, what was asked was the number of guavas from each child given by Mother and Father but the students understood the total number of fruits Dad and Mom's guava given to children, apart from that students make mistakes in transforming questions into mathematical form, students don't know how to change story questions into mathematical calculation sentence models and make mistakes in process skills and final answers, where students don't know The correct way to calculate fractional numbers is to equate the denominators first, for example calculating the total of Ali's guava fruit given by Ali's mother and father: $\frac{5}{3}$+ $\frac{14}{6}$= $\frac{10\ +\ 14}{6}$= $\frac{24}{6}$= 4 kg . So the denominators are equalized first then add the numerator.

Discussion

Based on the description of the research results, it is known that the problems of SD Mantingan 2 students related to HOTS type story questions in fraction material were mostly in the *Encoding indicator* or final answer because the answers did not match the questions stated in the questions, the students' lack of precision and accuracy in calculating which caused the final answer to be wrong, students do not write conclusions about the answers they get, this is because students are not used to concluding the answers they get. This is different from the results of Febryana's research which stated that the most errors were found in *Process Skill errors* (Febryana et al., 2023). Other types of errors such as *Transformation* and *Process Skill* also affect the final answer obtained by students. However, *Reading* and *Comprehension indicators* need special attention. According to Rohmah , the beginning of students' mistakes in solving questions depends on how students read and understand the questions (Rohmah & Sutiarso, 2018). According to Febryana's research results, it is also known that due to a lack of ability to understand, students cannot understand the meaning in the contents of the questions. Apart from that, students are also in a hurry to complete the questions, this causes students to write less and write the content in the questions incorrectly, so they do it wrong. This is because the HOTS questions are related to each other, so if you are wrong in reading the questions, understanding the questions, transforming the questions, and skills in the questions, then most of the final answers will definitely be wrong.

Conclusion

Based on the research results and discussion, information was obtained from all data that the majority of students made mistakes when solving fractional questions of the *Higher Order Thinking Skills* (HOTS) type. In this study, it was concluded that students' errors in doing problems on the comprehension and reading indicators were the cause of students doing wrong even though most of the biggest mistakes were in the encoding indicators.

The limitation of this research is the research subject, so the results of the research are likely to be different from existing research and research that will be carried out next. Suggestions for future researchers are the need to carry out further research to examine various aspects starting from how teachers teach, how students are interested in learning so that it can be seen how much potential students have in taking HOTS type story questions. This is necessary to cover aspects broader research.

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